

Revolutionizing Space Transportation

*for the
21st Century*

June 2001



Revolutionizing Space Transportation

Agenda

***Integrated Space
Transportation Plan***

Art Stephenson

Director,
Marshall Space Flight Center

Space Launch Initiative

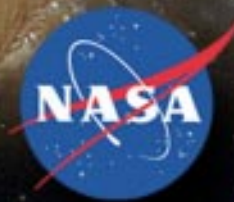
Dennis Smith

Manager,
*2nd Generation RLV Program
Marshall Space Flight Center*

***3rd Generation & In-
Space Research and
Technology***

Steve Cook

Deputy Manager,
*Advanced Space Transportation Program
Marshall Space Flight Center*



Integrated Space Transportation Plan

***A National Plan for Ensuring U.S.
Leadership in Space***

Art Stephenson
Director
Marshall Space Flight Center

National Vision: Global Leadership In Space



U.S. Space Policy

- **Support a Strong, Stable and Balanced Space Program**
 - ***Economic Development***
 - ***Science & Technology Advancement***
 - ***National Defense***

Access to Space is Central for Leadership

Global Leadership in Space: Who will Lead?



U.S. Faces Critical Challenges

- *U.S. Launch Capability Is Based on Decades-Old Technology*
- *U.S. Launch Systems Are Expensive and Risky*
- *Foreign Companies Now Control the Majority of the Launch Market*

Safer, More Reliable and Affordable Access is the Key to Space Leadership



National Space Policy: NASA's Role

- **Enable the Development of a Next- Generation Reusable Launch Vehicle (RLV) to Ensure America's Role As the World's Leader in Space**
- **Assure Reliable and Affordable Access to Space Through U.S. Space Transportation Capability**
- **Keep the Shuttle Flying Safely Until a Replacement Vehicle Is Operational**

Provide Technological Leadership and Advancements For the Nation's Aerospace Industry

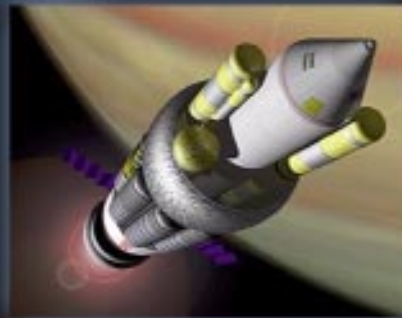
Integrated Space Transportation Plan: A National Plan



Space Shuttle Safety Upgrades



- **Space Launch Initiative**
 - 2nd Generation RLV Risk Reduction
 - NASA Unique Systems
 - Alternate Access to the ISS



3rd Generation and In-Space Research and Technology

***NASA's Long-Term Investment Strategy to Increase the Safety,
Reliability and Reduce the Cost of Space Access***



Where We Are Today: Space Shuttle - America's 1st Generation RLV

***Safety Upgrades
Ensures that the Shuttle
Will Fly Safely Until a 2nd
Generation RLV is
Operational***

"Smart Cockpit"



Advanced
Space Shuttle
Main Engine



Tank Manufacturing
Improvements

The Next Step: 2nd Generation RLV



Space Launch Initiative

*The Plan for Increasing the Safety,
Reliability and Affordability of a 2nd
Generation RLV*

Dennis Smith
*Program Manager,
2nd Generation RLV Program
Marshall Space Flight Center*



Space Launch Initiative

“NASA’s Space Launch Initiative provides commercial industry with the opportunity to meet NASA’s future launch needs, including human access to space, with new launch vehicles that promise to dramatically reduce cost and improve safety and reliability.”

*From the Administration’s
“Blueprint for New Beginnings”
February 2001*



SLI: The Hard Work Behind the Dream



- Crafting a new aerospace launch industry.
- Developing new management systems & tools.
- Advancing new technologies and engineering systems & tools.
- Creating new market planning & development systems & tools.

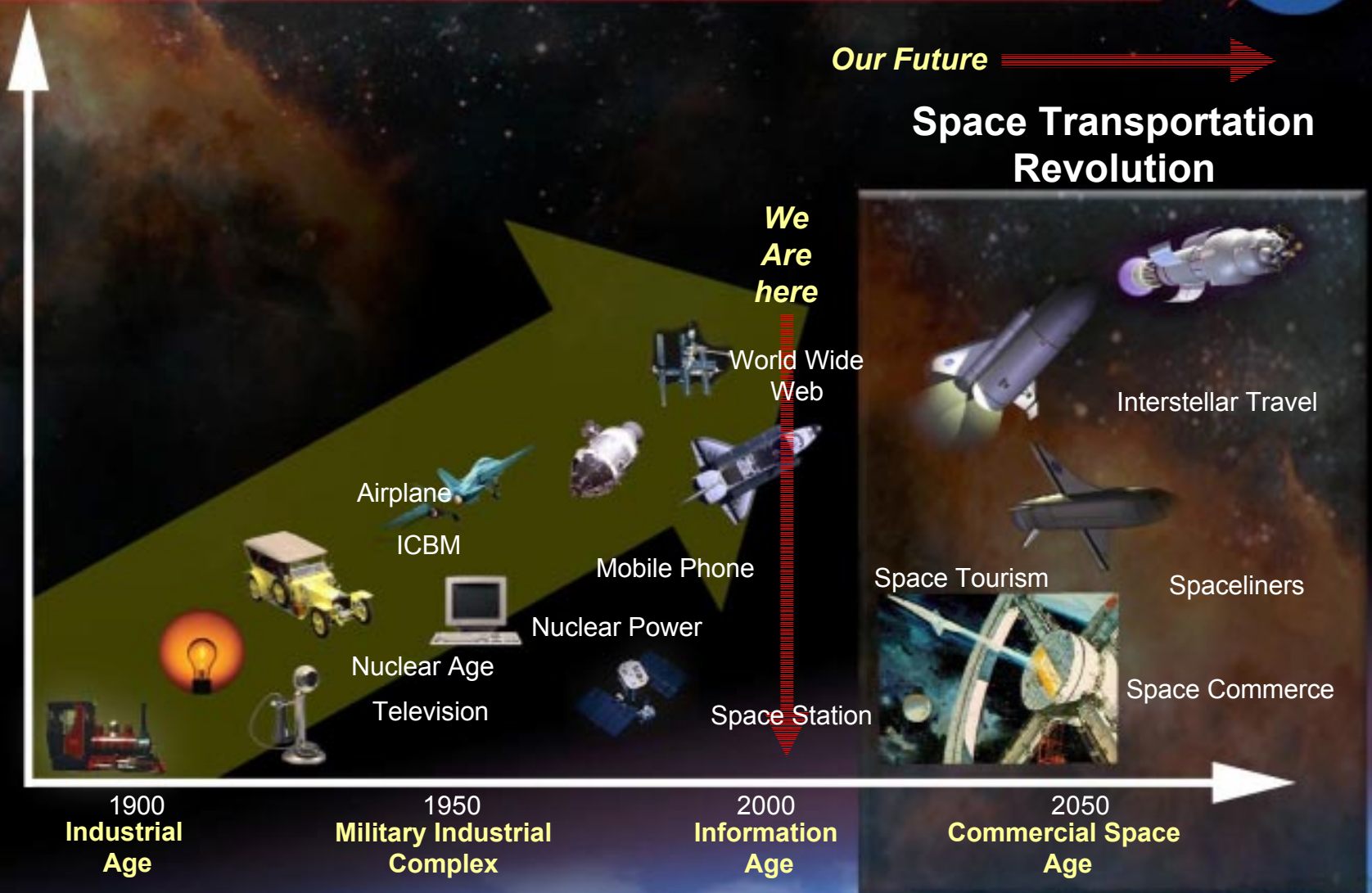


Accountability and Disciplined Innovation for the Nation



We Shape Our Future with Technology

Economy, Earnings & Jobs

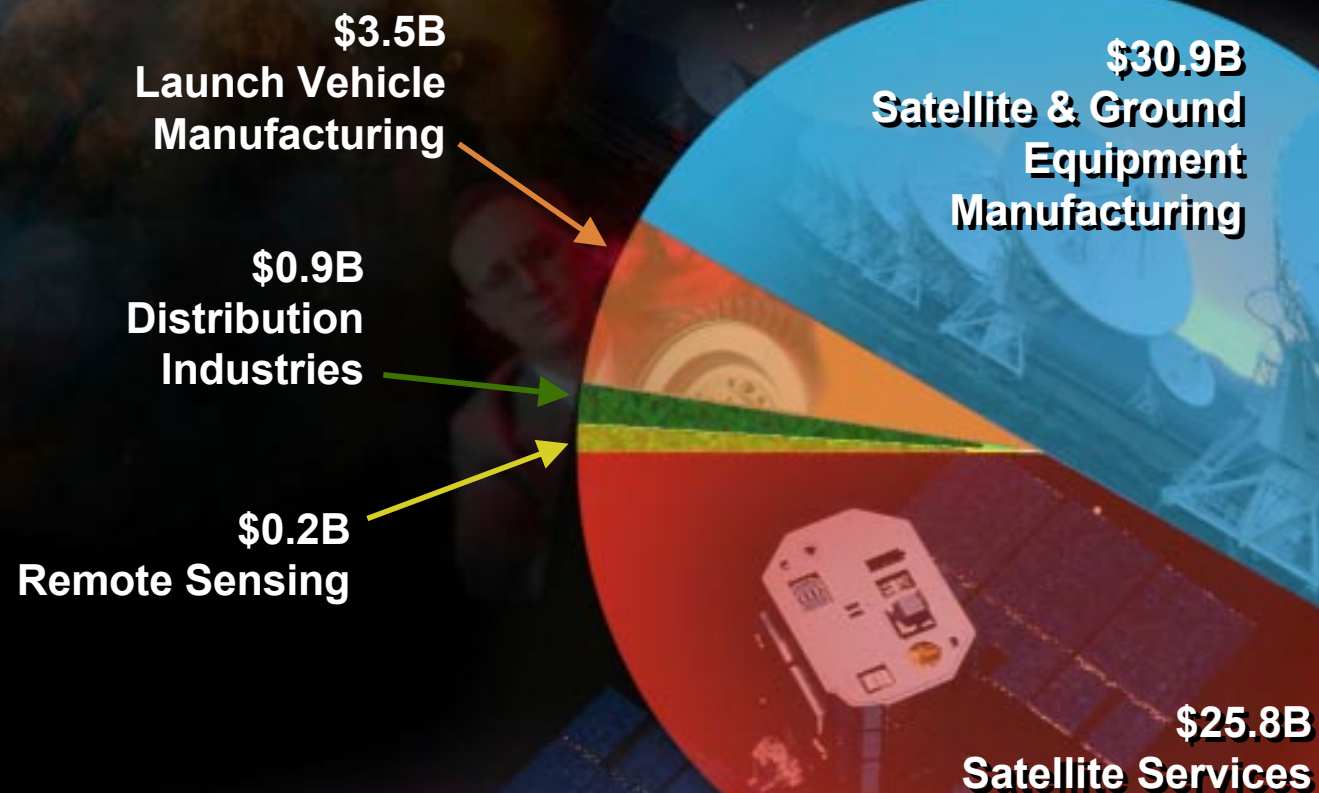


Investments in Space Transportation Now Will Enable the Next Wave of Innovation

Commercial Space Transportation Economic Activity



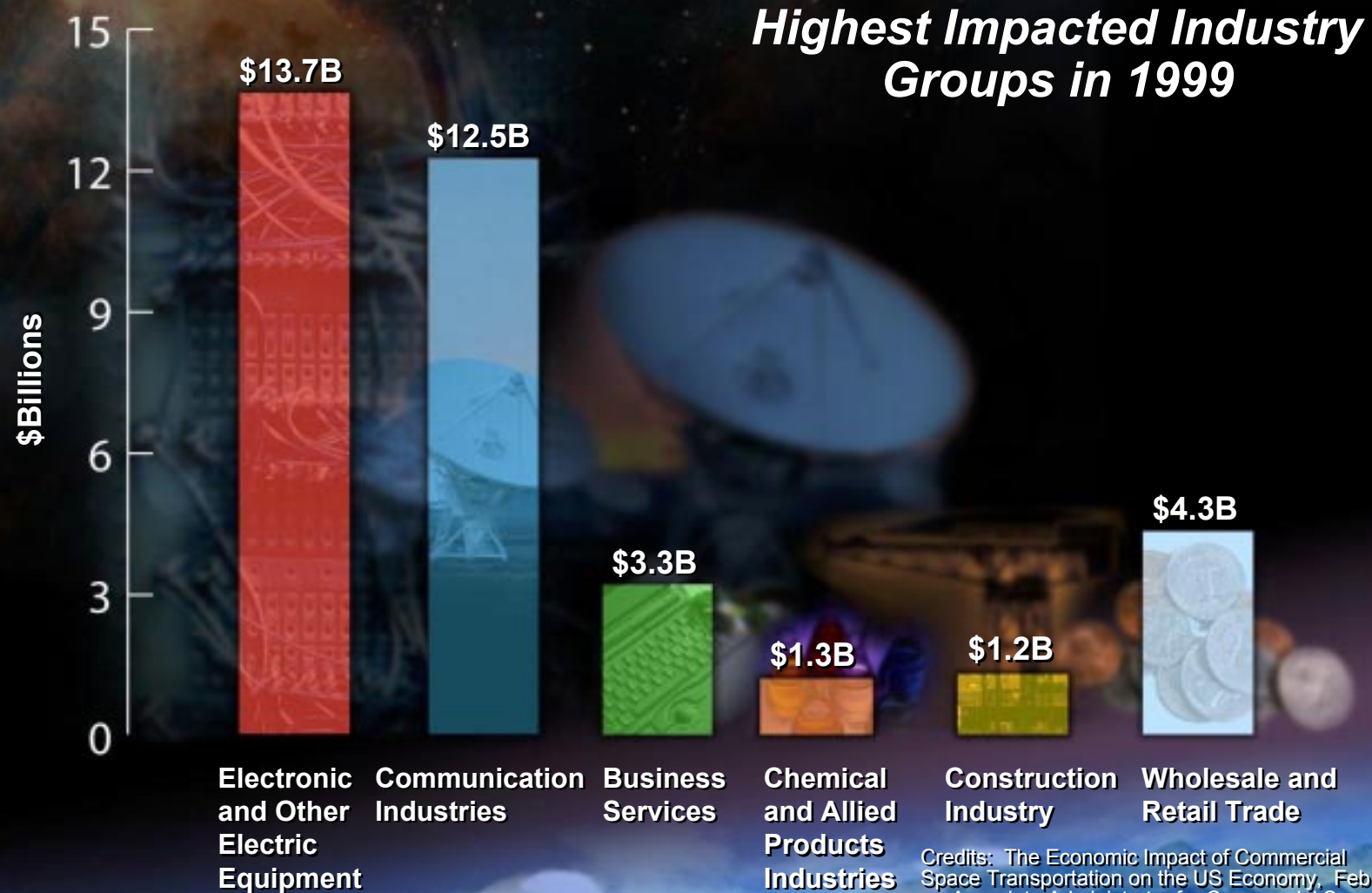
Total Economic Activity of \$61.3B in 1999



Credits: The Economic Impact of Commercial
Space Transportation on the US Economy, Feb. 2001

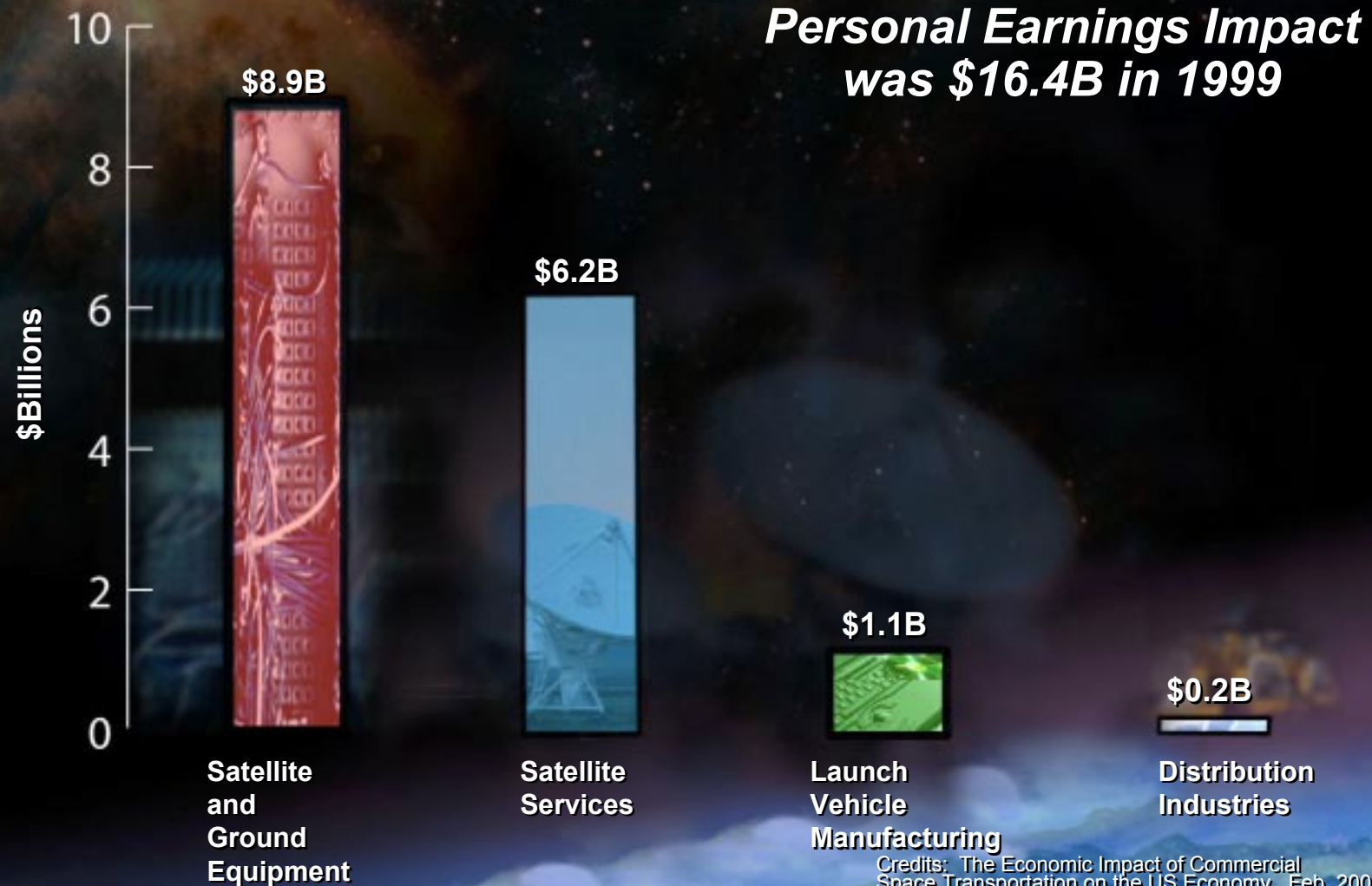
- Associate Administrator for Commercial Space Transportation
- Federal Aviation Administration
- U.S. Department of Transportation

Commercial Space Transportation Economic Activity



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Commercial Space Transportation Economic Activity

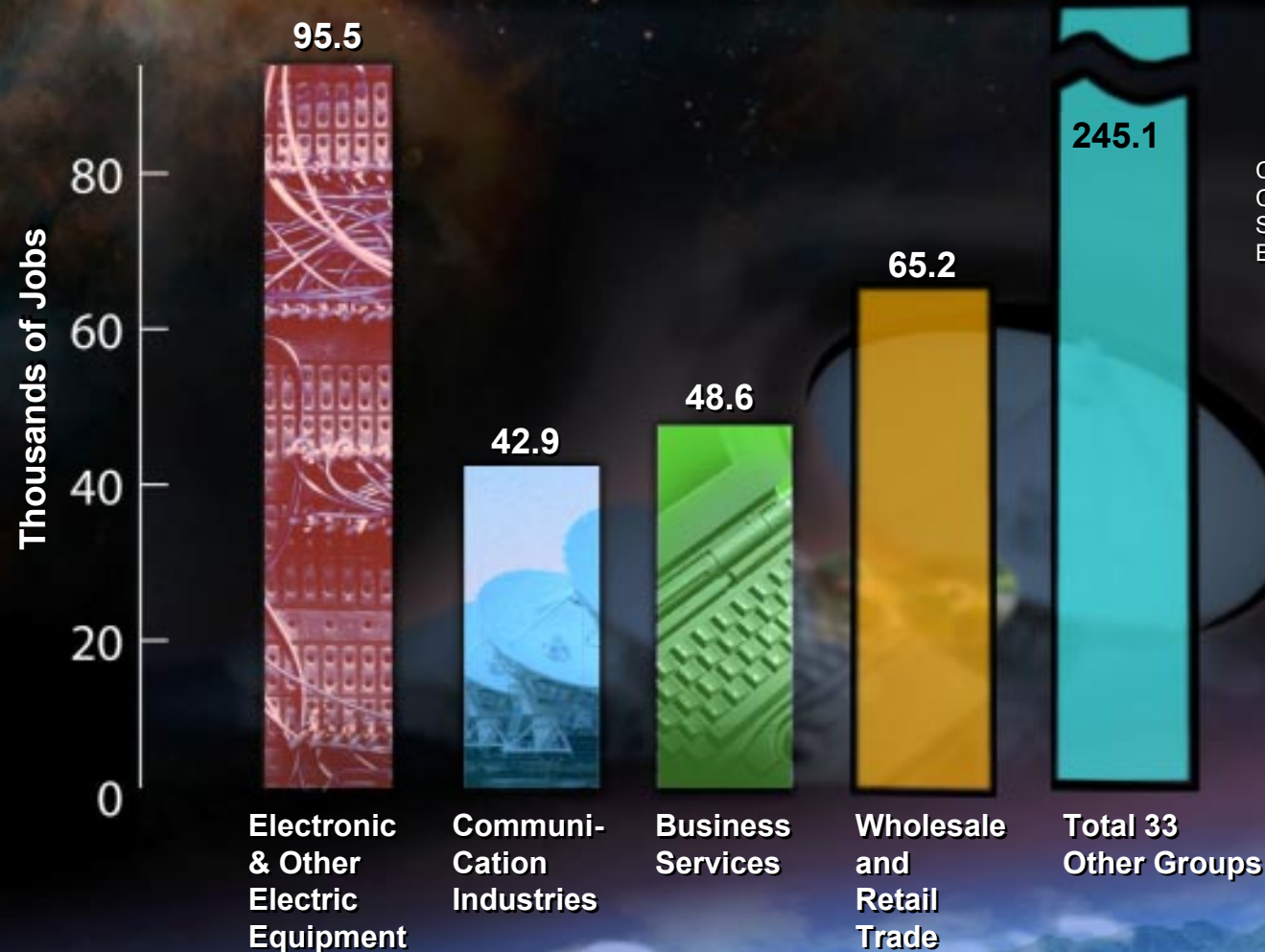


Credits: The Economic Impact of Commercial Space Transportation on the US Economy, Feb. 2001
• Associate Administrator for Commercial Space Transportation
• Federal Aviation Administration
• U.S. Department of Transportation



Commercial Space Transportation Economic Activity

Over 497,000 Jobs Created or Maintained in 1999



Credits: The Economic Impact of
Commercial
Space Transportation on the US
Economy, Feb. 2001

- Associate Administrator for
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- Federal Aviation Administration
- U.S. Department of Transportation

The Future of Commercial Space Transportation



- **State or Commercially-owned Spaceports**
- **Satellite Internet Content Delivery**
- **Improved Disaster Relief and Emergency Communications**
- **Satellite-aided Agriculture**
- **Sub-orbital Fast-package Delivery**
- **Space Manufacturing**
- **Space Tourism**
- **Exploration of Extraterrestrial Resources**
- **Solar Space Power**

Credits: The Economic Impact of Commercial Space Transportation on the US Economy, Feb. 2001

- Associate Administrator for Commercial Space Transportation
- Federal Aviation Administration
- U.S. Department of Transportation



2nd Generation RLV Program

Goals

Safety - Improve Safety to 1 to 10,000 Loss of Crew
Cost - Reduce NASA's Mission Price to \$1,000/lb

Objectives

- Converged Set of Government and Commercial Requirements
- Integrated with Rigorous Systems Engineering Processes
- Architecture Definitions and Designs
- Risk Reduction Activities
- Knowledge Base for Informed Decisions
- Competition





2nd Generation RLV Program

Enables Competing Architectures

Propulsion

Avionics

Vehicle Systems

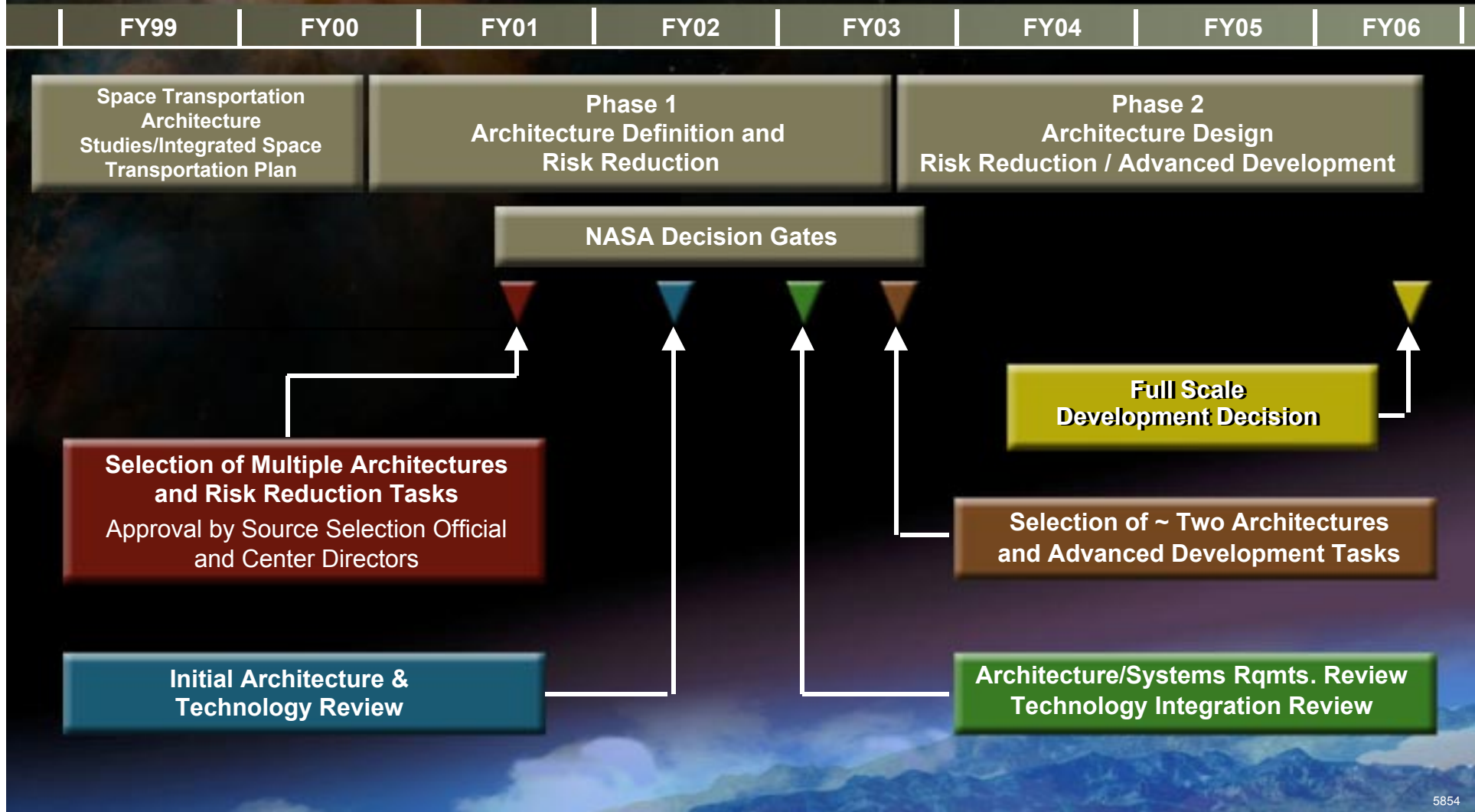
Airframe

Operations

**Risk Reduction Technologies to Enable Safer,
More Reliable and Lower Cost Systems**



2nd Generation RLV Program Schedule

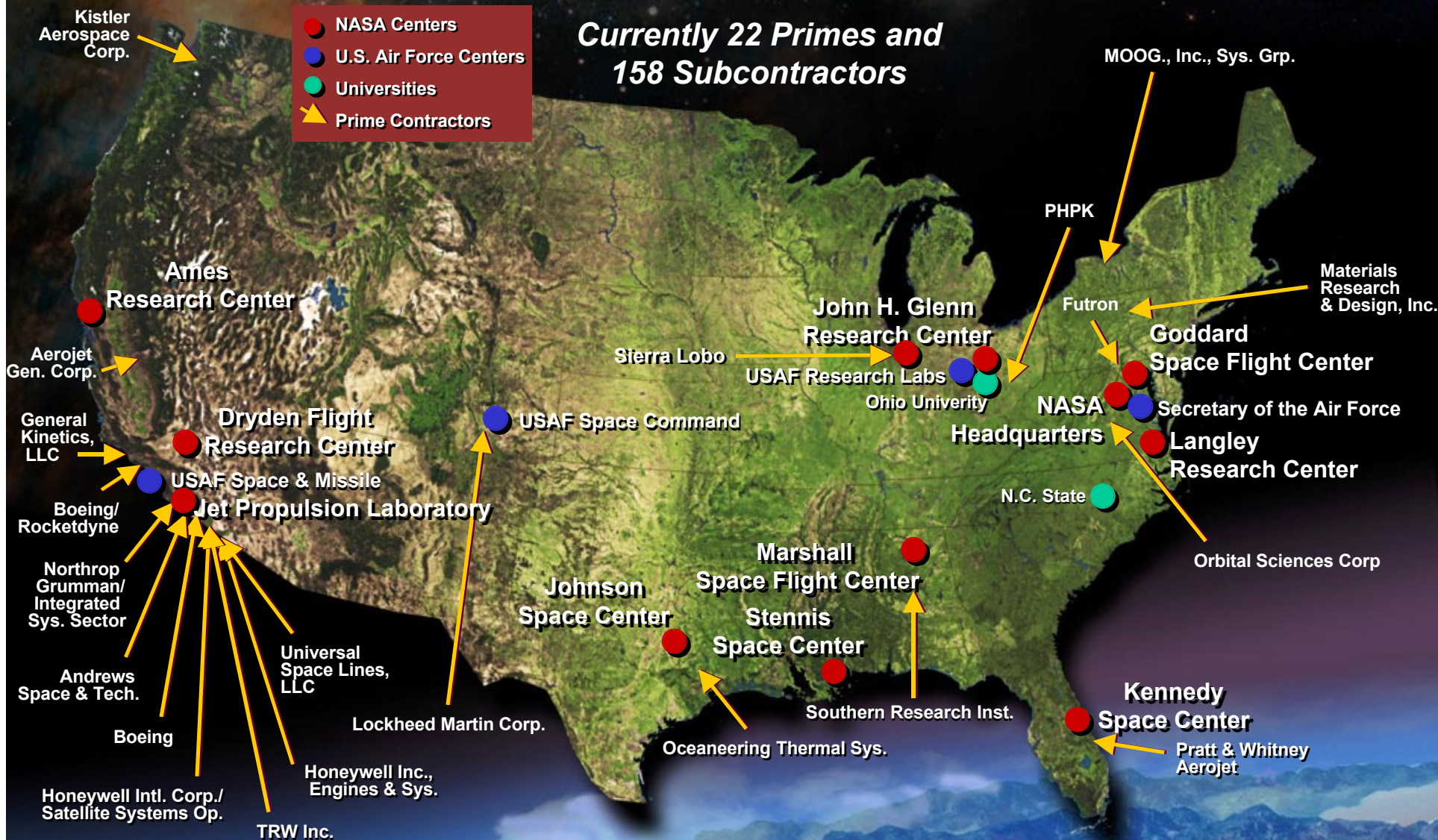


2nd Generation RLV Program: The Work of a Nation



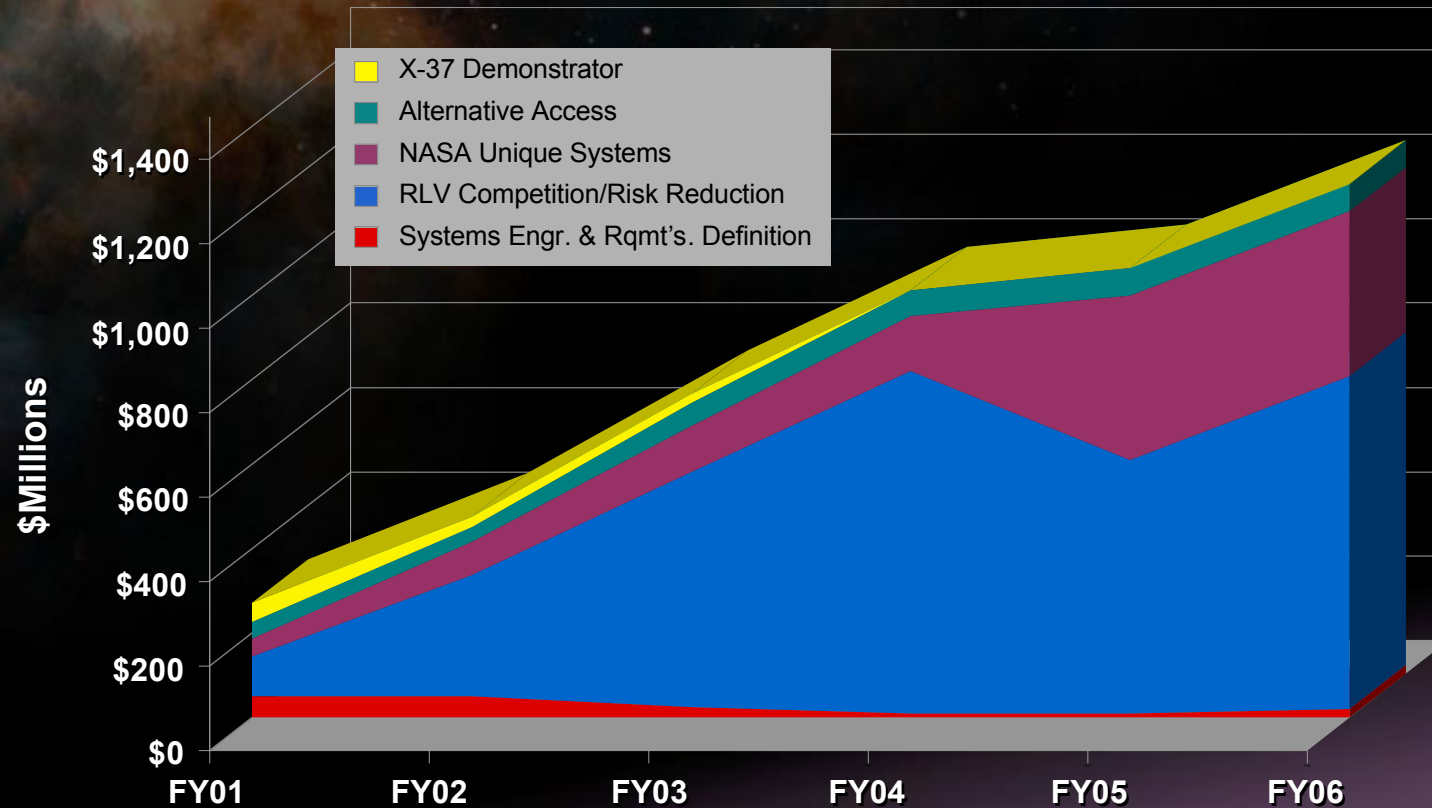
**Currently 22 Primes and
158 Subcontractors**

- NASA Centers
- U.S. Air Force Centers
- Universities
- ▲ Prime Contractors





2nd Generation RLV Program Budget




- ***\$4.85 B Investment to Enable the Development of a 2nd Generation RLV***



Evolution of Transportation

*Throughout History,
Transportation Has Been
the Key to Economic
Progress and Discovery*

*2nd Generation RLV
will Lead the Way in the
21st Century*

3000 BC 1500 AD 1800 1900 1950 1990 2010 2030 2045 

Exploring the Future

3rd Generation and In-Space Research and Technology

Steve Cook
*Deputy Manager,
Advanced Space Transportation Program
Marshall Space Flight Center*



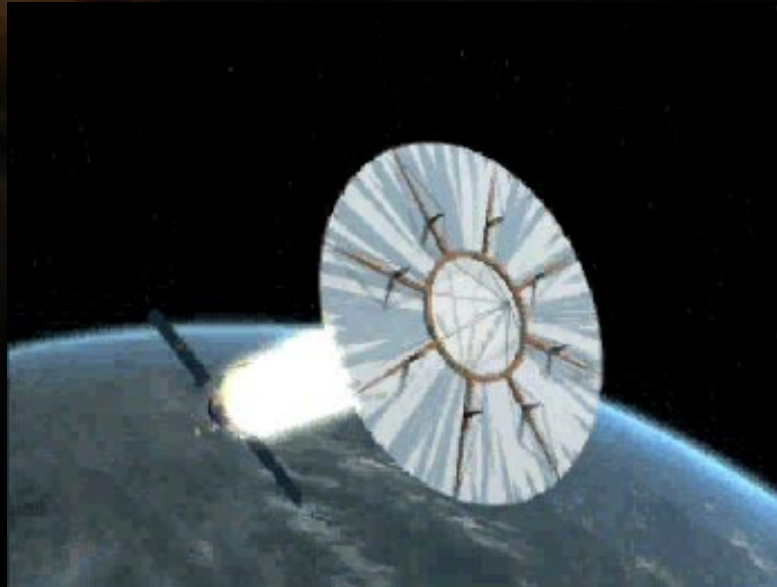
Imagine Beyond the Next Decade...



New Space Capabilities Require Revolutionary Improvements in Transportation



Ensuring Seamless National Aero-Space Security



Space Adventure Travel and Tourism



Expanded Scientific Exploration within Our Solar System and Beyond....



Assembly and Service of Complex Space Platforms

3rd Generation RLV

Routine Space Access: Enabling New Capabilities in Space



- **Military Space Operations**
 - Call-up in Hours
 - All-Weather Operations
 - Global Reach in 90min
- **New Commercial Industries**
 - Tourism
 - Space Business Parks
 - Pharmaceutical and Materials R&D Labs
- **Space Station Support**
 - On-Demand Crew Rescue
 - Logistics Resupply
- **Staging Points for Exploration**
- **Civil and Military Aviation Spinoffs**

Broad Set of Concept Options with Common Technologies



3rd Generation RLV

Revolutionary Technology Requirements



Ram and Scramjet
Propulsion

Lightweight, Integrated
Rockets

Lightweight Integrated Thermal-Structures

Integrated Vehicle Health Maintenance
And Sensors

Revolutionary Design
Tools

Airline-like
Operations

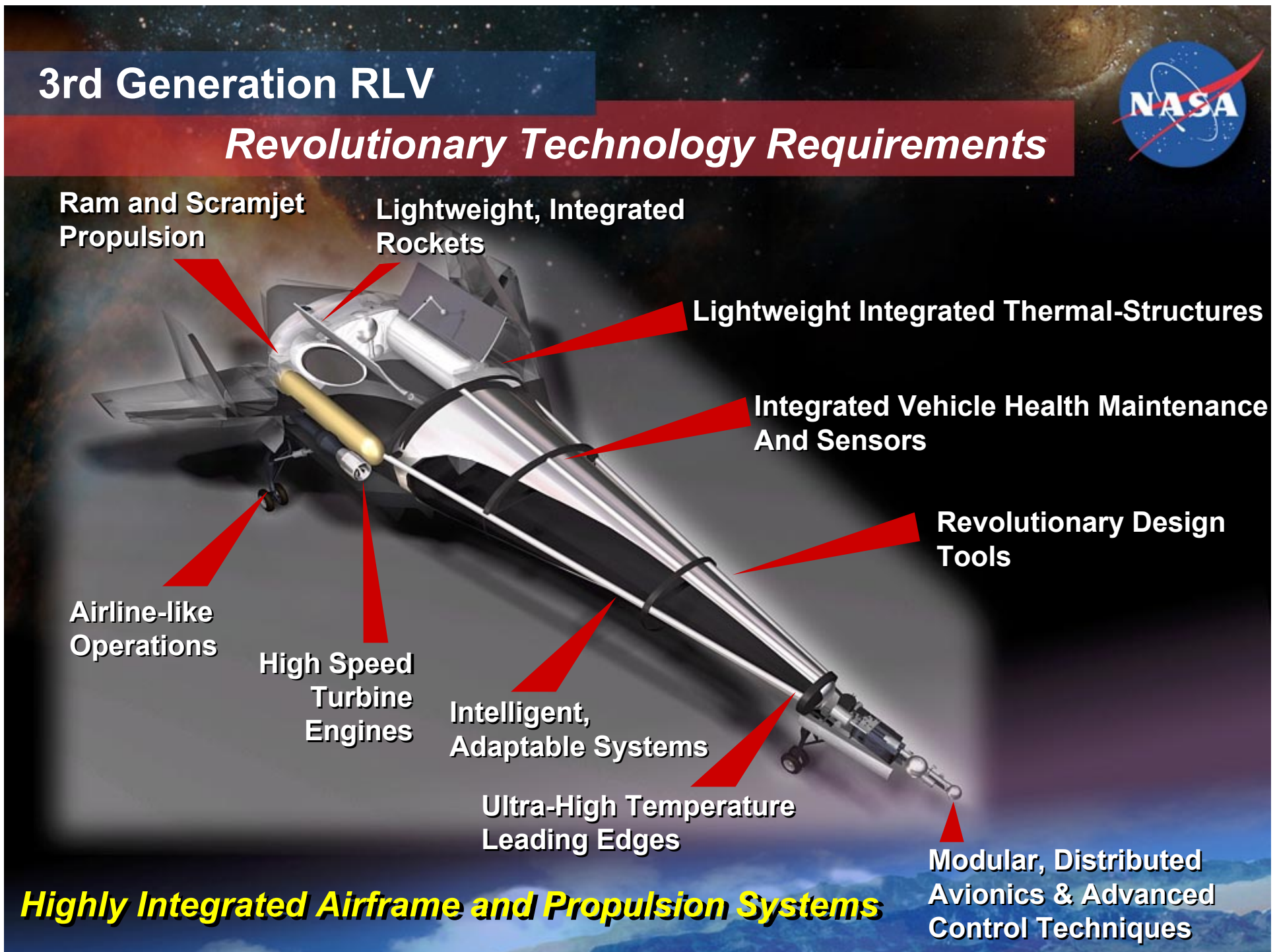
High Speed
Turbine
Engines

Intelligent,
Adaptable Systems

Ultra-High Temperature
Leading Edges

Modular, Distributed
Avionics & Advanced
Control Techniques

Highly Integrated Airframe and Propulsion Systems

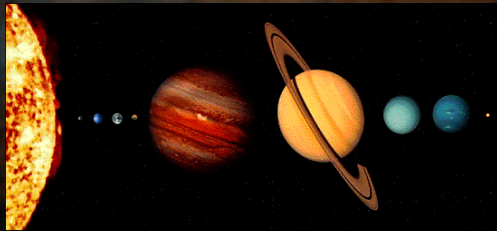


In-Space Transportation

Enabling New Scientific Discoveries

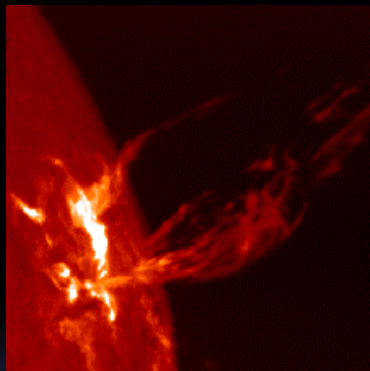


Solar System Exploration



- Pluto Rendezvous
- Neptune / Uranus Orbiters
- Europa Orbiters / Landers
- Titan Orbiters / Landers
- Mars Orbiters / Landers / Return Stages
- Interstellar Precursor Missions

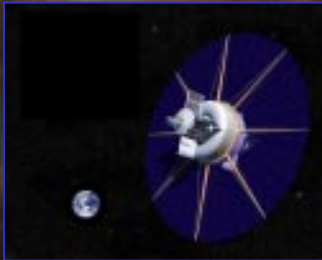
Sun Earth Connection



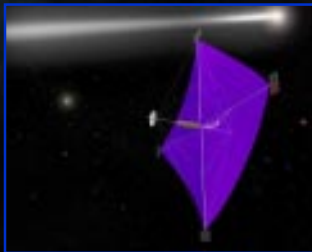
- Space Weather Observers
- Solar Science
 - LaGrange Missions
 - Orbiters
 - Pole Sitters
- Multi-Spacecraft Missions/Formation Flight

In-Space Propulsion

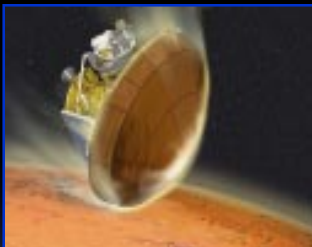
Revolutionary Technology Requirements



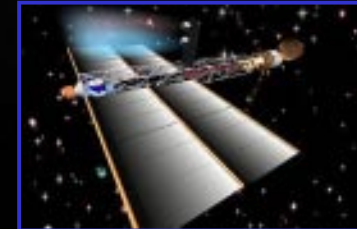
Solar Electric Propulsion



Solar and Plasma Sails



Planetary Aeroassist



Fission Propulsion



Chemical Propulsion



Tethers

Propulsion Research

Unlocking the Potential of A Broad Spectrum of Revolutionary Concepts



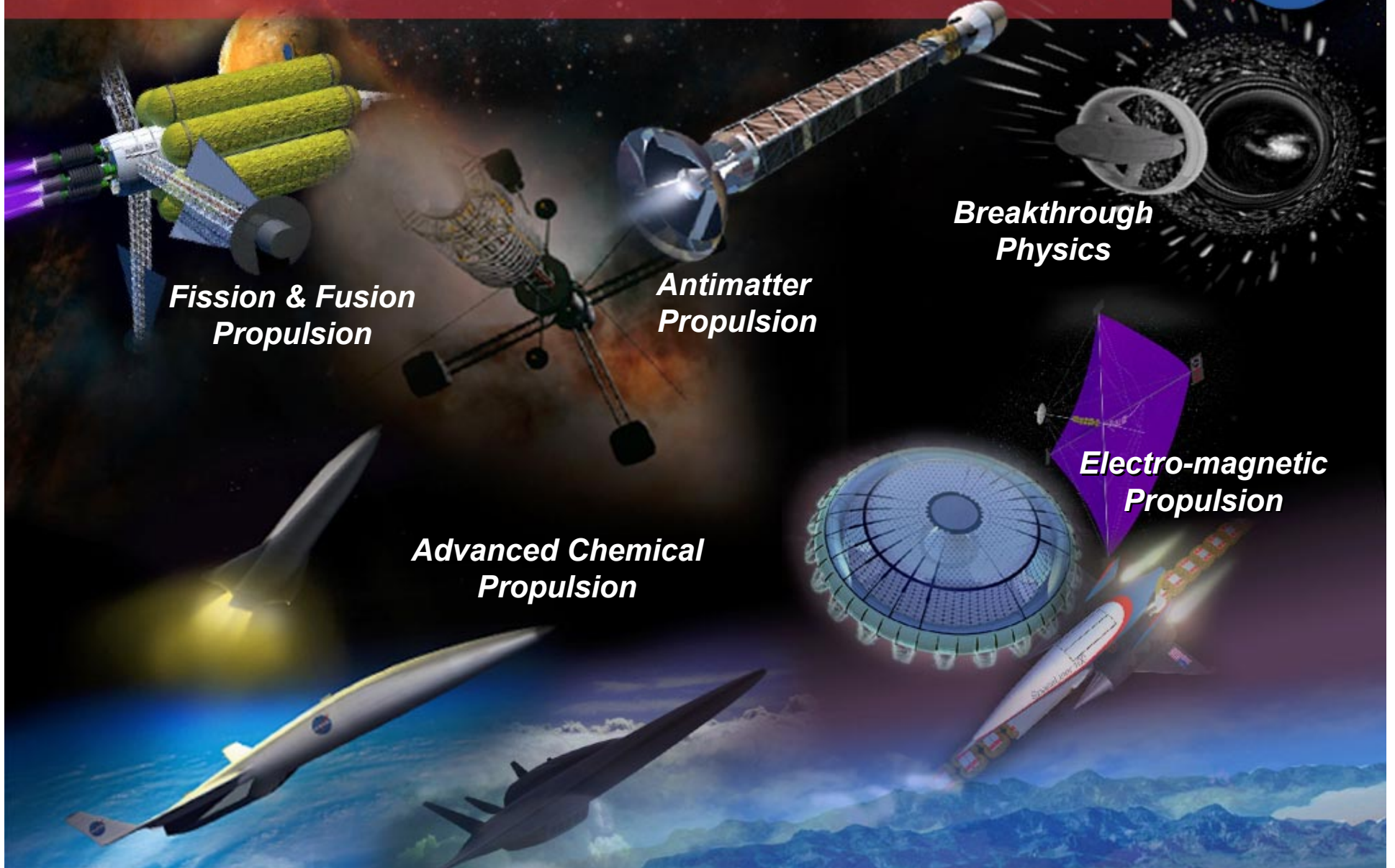
**Fission & Fusion
Propulsion**

**Antimatter
Propulsion**

**Breakthrough
Physics**

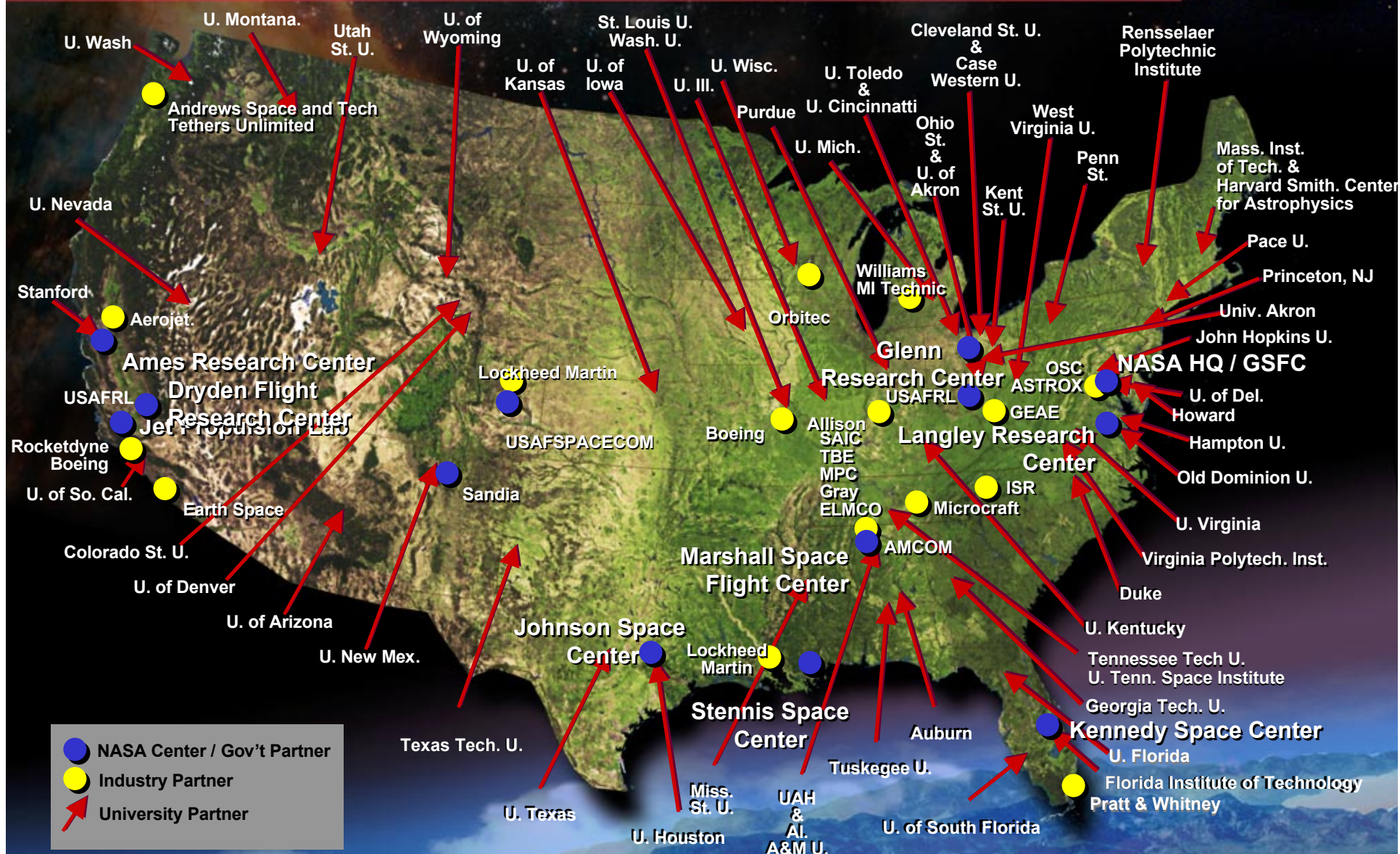
**Advanced Chemical
Propulsion**

**Electro-magnetic
Propulsion**



A National Team Effort

Developing Revolutionary Technologies to Explore the Future



Global Leadership in Space... Who will lead?

**THE FUTURE HOLDS CRITICAL CHALLENGES TO
U.S. CONTINUED GROWTH AND PERFORMANCE IN
SPACE**

**SAFER, MORE RELIABLE AND AFFORDABLE
ACCESS TO SPACE IS THE KEY**

**ISTP IS THE NATIONAL PLAN FOR
ENSURING U.S. LEADERSHIP IN
SPACE**

www.spacetransportation.com

